REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
01 05 2011	Master of Military Studies Research Paper	September 2010 - April 2010

4. TITLE AND SUBTITLE
Carrier Aviation and Hybrid Conflict: The Future of the Strike Fighter

5a. CONTRACT NUMBER
N/A

5b. GRANT NUMBER
N/A

5c. PROGRAM ELEMENT NUMBER
N/A

6. AUTHOR(S)
LCDR Smetana

5d. PROJECT NUMBER
N/A

5e. TASK NUMBER
N/A

5f. WORK UNIT NUMBER
N/A

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
USMC Command and Staff College
Marine Corps University
2076 South Street
Quantico, VA 22134-5068

8. PERFORMING ORGANIZATION REPORT NUMBER
N/A

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
N/A

10. SPONSOR/MONITOR'S ACRONYM(S)
N/A

11. SPONSORING/MONITORING AGENCY REPORT NUMBER
N/A

12. DISTRIBUTION AVAILABILITY STATEMENT
Unlimited

13. SUPPLEMENTARY NOTES
N/A

14. ABSTRACT

In the current operating environment, Naval Aviation is required to perform more missions with less aircraft. The decks of the carrier once dominated by a vast array of combat aircraft now contain smaller numbers of multi-mission aircraft; moreover, the decrease in the strike fighter community's readiness correlates directly to the increase of missions for the F/A-18 since 1992. The strike fighter community, operating the F/A-18 C/E/F, must maintain a balance of missions across a full spectrum to meet future challenges. The difficulty lies in achieving balance across missions historically dedicated to specialized platforms. Over the last twenty years, the strike fighter-training program gravitated towards more air-to-ground operations, which reflected the combat environment of the post-Cold War. The current training and readiness matrix reflects the importance of air-to-ground missions yet also maintains the critical air-to-air skill sets. The effectiveness of the training is dependent on the prioritization of air-to-ground missions, a direct reflection of the culture in the strike fighter community. Air-to-air centrism characterizes the overarching mindset of the strike fighter community. Two key programs exemplify the focus on air-to-air: TOPGUN and the Strike Fighter Weapons and Tactics program (SFWT). The programs create a culture where greater emphasis is placed upon air-to-air which contradicts the critical mission tasks and overall delineation of the training and readiness matrix. A TOPGUN syllabus more closely reflecting the multi-role capability of the F/A-18 will ensure that the "graduate level" program reflects the full spectrum of operations and ultimately will balance the underlying culture of the strike fighter community. A revision to the SFWT syllabus with robust air-to-ground flights will more accurately reflect the operating environment and better prepare aircrew for current and future conflicts. Additionally, minor revisions incorporating joint close air support (CAS), maritime air strike (MAS), unmanned aerial systems (UAS) integration, and robust surface to air counter tactics (SACT) into training will better

INSTRUCTIONS FOR COMPLETING SF 298

prepare strike fighter aircrew for the future battlefields. To stay relevant, effective, and lethal in future conflicts the strike fighter community must ensure air-to-ground missions are given the same priority as air-to-air missions. The near term and midterm operating environments demonstrates the majority of the missions will fall under the domain of air-to-ground, necessitating a greater emphasis on the attack portion of missions and driving the strike fighter community's collective mindset more towards the "A" of the "F/A-18".

15. SUBJECT TERMS

Naval Aviation, Carrier Aviation, Strike Fighter, Hybrid Warfare,

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
					Marine Corps University / Command and Staff College
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**	UU	39	**19b. TELEPONE NUMBER (*Include area code*)**
Unclass	Unclass	Unclass			(703) 784-3330 (Admin Office)

INSTRUCTIONS FOR COMPLETING SF 298

1. REPORT DATE. Full publication date, including day, month, if available. Must cite at lest the year and be Year 2000 compliant, e.g., 30-06-1998; xx-08-1998; xx-xx-1998.

2. REPORT TYPE. State the type of report, such as final, technical, interim, memorandum, master's thesis, progress, quarterly, research, special, group study, etc.

3. DATES COVERED. Indicate the time during which the work was performed and the report was written, e.g., Jun 1997 - Jun 1998; 1-10 Jun 1996; May - Nov 1998; Nov 1998.

4. TITLE. Enter title and subtitle with volume number and part number, if applicable. On classified documents, enter the title classification in parentheses.

5a. CONTRACT NUMBER. Enter all contract numbers as they appear in the report, e.g. F33615-86-C-5169.

5b. GRANT NUMBER. Enter all grant numbers as they appear in the report, e.g. 1F665702D1257.

5c. PROGRAM ELEMENT NUMBER. Enter all program element numbers as they appear in the report, e.g. AFOSR-82-1234.

5d. PROJECT NUMBER. Enter al project numbers as they appear in the report, e.g. 1F665702D1257; ILIR.

5e. TASK NUMBER. Enter all task numbers as they appear in the report, e.g. 05; RF0330201; T4112.

5f. WORK UNIT NUMBER. Enter all work unit numbers as they appear in the report, e.g. 001; AFAPL30480105.

6. AUTHOR(S). Enter name(s) of person(s) responsible for writing the report, performing the research, or credited with the content of the report. The form of entry is the last name, first name, middle initial, and additional qualifiers separated by commas, e.g. Smith, Richard, Jr.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES). Self-explanatory.

8. PERFORMING ORGANIZATION REPORT NUMBER. Enter all unique alphanumeric report numbers assigned by the performing organization, e.g. BRL-1234; AFWL-TR-85-4017-Vol-21-PT-2.

9. SPONSORING/MONITORS AGENCY NAME(S) AND ADDRESS(ES). Enter the name and address of the organization(s) financially responsible for and monitoring the work.

10. SPONSOR/MONITOR'S ACRONYM(S). Enter, if available, e.g. BRL, ARDEC, NADC.

11. SPONSOR/MONITOR'S REPORT NUMBER(S). Enter report number as assigned by the sponsoring/ monitoring agency, if available, e.g. BRL-TR-829; -215.

12. DISTRIBUTION/AVAILABILITY STATEMENT. Use agency-mandated availability statements to indicate the public availability or distribution limitations of the report. If additional limitations/restrictions or special markings are indicated, follow agency authorization procedures, e.g. RD/FRD, PROPIN, ITAR, etc. Include copyright information.

13. SUPPLEMENTARY NOTES. Enter information not included elsewhere such as: prepared in cooperation with; translation of; report supersedes; old edition number, etc.

14. ABSTRACT. A brief (approximately 200 words) factual summary of the most significant information.

15. SUBJECT TERMS. Key words or phrases identifying major concepts in the report.

16. SECURITY CLASSIFICATION. Enter security classification in accordance with security classification regulations, e.g. U, C, S, etc. If this form contains classified information, stamp classification level on the top and bottom of this page.

17. LIMITATION OF ABSTRACT. This block must be completed to assign a distribution limitation to the abstract. Enter UU (Unclassified Unlimited) or SAR (Same as Report). An entry in this block is necessary if the abstract is to be limited.

United States Marine Corps
Command and Staff College
Marine Corps University
2076 South Street
Marine Corps Combat Development Command
Quantico, Virginia 22134-5068

MASTER OF MILITARY STUDIES

CARRIER AVIATION AND HYBRID CONFLICT: THE FUTURE OF THE STRIKE FIGHTER

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE
OF MASTER OF MILITARY STUDIES

LCDR Nicholas Smetana, USN
USMC Command and Staff College

AY 10-11

Mentor and Oral Defense Committee Member: Dr. Paul D. Gaust
Approved: [signature]
Date: 6 April 2011

Oral Defense Committee Member: Dr. Douglas G. Streesand
Approved: [signature]
Date: 6 April 2011

Executive Summary

Title: Carrier Aviation and Hybrid Conflict: The Future of the Strike Fighter

Author: Lieutenant Commander Nicholas Smetana, United States Navy

Thesis: The strike fighter community must fully embrace air to ground missions to ensure the multi-role strike fighter is prepared for the wars of today and the full spectrum conflicts of the future.

Discussion: In the current operating environment, Naval Aviation is required to perform more missions with less aircraft. The decks of the carrier once dominated by a vast array of combat aircraft now contain smaller numbers of multi-mission aircraft; moreover, the decrease in the strike fighter community's readiness correlates directly to the increase of missions for the F/A-18 since 1992. The strike fighter community, operating the F/A-18 C/E/F, must maintain a balance of missions across a full spectrum to meet future challenges. The difficulty lies in achieving balance across missions historically dedicated to specialized platforms. Over the last twenty years, the strike fighter-training program gravitated towards more air-to-ground operations, which reflected the combat environment of the post-Cold War. The current training and readiness matrix reflects the importance of air-to-ground missions yet also maintains the critical air-to-air skill sets. The effectiveness of the training is dependent on the prioritization of air-to-ground missions, a direct reflection of the culture in the strike fighter community. Air-to-air centrism characterizes the overarching mindset of the strike fighter community. Two key programs exemplify the focus on air-to-air: TOPGUN and the Strike Fighter Weapons and Tactics program (SFWT). The programs create a culture where greater emphasis is placed upon air-to-air which contradicts the critical mission tasks and overall delineation of the training and readiness matrix. A TOPGUN syllabus more closely reflecting the multi-role capability of the F/A-18 will ensure that the "graduate level" program reflects the full spectrum of operations and ultimately will balance the underlying culture of the strike fighter community. A revision to the SFWT syllabus with robust air-to-ground flights will more accurately reflect the operating environment and better prepare aircrew for current and future conflicts. Additionally, minor revisions incorporating joint close air support (CAS), maritime air strike (MAS), unmanned aerial systems (UAS) integration, and robust surface to air counter tactics (SACT) into training will better prepare strike fighter aircrew for the future battlefields.

Conclusion: To stay relevant, effective, and lethal in future conflicts the strike fighter community must ensure air-to-ground missions are given the same priority as air-to-air missions. The near term and midterm operating environments demonstrates the majority of the missions will fall under the domain of air-to-ground, necessitating a greater emphasis on the attack portion of missions and driving the strike fighter community's collective mindset more towards the "A" of the "F/A-18".

DISCLAIMER

THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS COMMAND AND STAFF COLLEGE OR ANY OTHER GOVERNMENTAL AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

Table of Contents

Disclaimer..... ii

Preface..... iv

Acronyms..... v

Introduction..... 1

The Post Cold-War Strike Fighter..... 3

The Post 9/11 Strike Fighter..... 4

Future Conflicts and the Strike Fighter..... 5

Current Strike Fighter Training..... 9

The Current Strike Fighter Culture..... 11

Recommendations for the Strike Fighter Community..... 18

Conclusion..... 22

Notes..... 25

Bibliography..... 29

Preface

During my second deployment in OEF, my pilot and I supported two subsequent firefights in a whirlwind of a flight. We expended all our ordnance, saved the Brits, and potentially eliminated a code-named terrorist. The following day we poured over our tapes but soon comments from "senior" aviators beckoned: "flights over," "stop watching your tapes," etc. Ready room antics are part of Naval Aviation, however, this was not jesting but rather a mindset. Why is it in our culture that we can pick apart an air-to-air flight in training for hours but not apply the same level of commitment to air-to-ground flights even during combat operations? To answer this question, I decided to research the training and culture of the strike fighter community to determine the mission prioritization between air-to-air and air-to-ground and its implications for future conflicts.

I would like to thank my wife, Jen, for her patience as I pounded away at my laptop during our first "shore tour." She also along with Chuck Smetana and Robert Kanach, provided critical edits for acronyms and aviation jargon. From the military side, CDR "Kato" DelaCruz and LCDR "Special K" Quinn offered invaluable feedback even if they disagreed with me at times. I would also like to thank the staffs at CSFWP, NSAWC, TOPGUN, and MAWTS-1 (especially MAJ "Peepers" Bowmer) for their cooperation. Additionally, I could have not completed this thesis without the instructions and syllabi provided by LCDR "Lick" Kihm from SFWSPAC. Finally, I was fortunate to have two mentors who trudged through numerous drafts and helped keep me on track. Colonel Ray Damm, USMC (retired) and Dr. Paul Gelpi offered their time, expertise, and advice that was critical in the completion of my thesis.

Acronyms

AAW	Anti Air Warfare
ACM	Air Combat Maneuvers
ACTI	Air Combat Tactics Instructor
AESA	Advanced Electronically Scanned Array
BAMS	Broad Area Maritime Surveillance
BFM	Basic Fighter Maneuvers
CAS	Close Air Support
CBM	Capabilities Based Matrix
CSAR	Combat Search and Rescue
DCA	Defensive Counter Air
FAC-A	Forward Air Controller Airborne
IDRC	Inter Deployment Readiness Cycle
IADS	Integrated Air Defense System
IW	Irregular Warfare
GAO	Government Accountability Office
JSF	Joint Strike Fighter
JTAC	Joint Terminal Air Controller
LFS	Large Force Strike
LGB	Laser Guided Bomb
MAS	Maritime Air Strike
MDTC	Marine Division Tactics Course
NTA	Naval Tactical Task
NTSIR	Non-Traditional Intelligence Surveillance Reconnaissance
OCA	Offensive Counter Air
OEF	Operation ENDURING FREEDOM
OIF	Operation IRAQI FREEDOM
PGM	Precision Guided Munitions
ROE	Rules of Engagement
SACT	Surface to Air Counter Tactics
SAM	Surface to Air Missile
SAR	Synthetic Aperture Radar
SEAD	Suppress Enemy Air Defenses
SFARP	Strike Fighter Advanced Readiness Program
SFTI	Strike Fighter Tactics Instructor
SFWT	Strike Fighter Weapons and Tactics
STW	Strike Warfare
T&R	Training and Readiness
TST	Time Sensitive Targets
UAS	Unmanned Aerial System
UCAS-D	Unmanned Combat Air System Carrier Demonstration
ULT	Unit Level Training

The very essence of U.S. carrier aviation today has become deep and sustained attack from the sea—as the principal player when nearby land bases are not available, as was the case in Enduring Freedom, and as a still-needed and much-welcomed equal contributor to joint and combined operations when adjacent shore bases are accessible, as was the case in Iraqi Freedom.[1]

- Benjamin Lambeth, *American Carrier Airpower At the Dawn of a New Century* (2005)

Introduction

The changing security environment of the past ten years transformed the Department of Defense, specifically the aviation communities. The military's focus on Irregular Warfare (IW) and increased reliance on Unmanned Aerial Systems (UAS) led to major cutbacks in aviation programs. In July 2009, the Senate cut spending for the F-22, a plane that had not seen a day of combat in Iraq or Afghanistan.[2] In January 2011, the Pentagon postponed the procurement of 124 Joint Strike Fighters (JSF) with cuts totaling $6.9 billion dollars over five years.[3] Uncertainty with the JSF, discussions on aircraft carrier reductions, and potential fighter gap demonstrates Naval Aviation also has its share of challenges.

In the current environment, Naval Aviation is required to do more missions with less aircraft. The decks of the carrier once dominated by a vast array of specialized aircraft now contain smaller numbers of multi-mission aircraft. The strike fighter community, operating the F/A-18 C/E/F, must maintain a balance of missions across the full spectrum of conflict. The difficulty lies in maintaining an effective multi-mission platform. The decrease in the strike fighter community's readiness since 1992 directly correlates to the increase of missions for the F/A-18.[4] The multi-mission capabilities of the F/A-18 create the "Swiss army knife of Naval Aviation" but at the same time also the proverbial "jack of all trades, master of none." The strike fighter community requires change to ensure the multi-role strike fighter is prepared for the wars of today and the full

spectrum conflicts of the future.

The change required is not a drastic one with specialization of squadrons or major revisions in training but a shift in mindset. Recently, Secretary of Defense Robert Gates declared a need "to shed the nostalgia that can too often consume the institutional culture of any large, successful organization."[5] The strike fighter community nostalgically defines a F/A-18 aviator as a "Fighter Pilot." The first commanding officer of Naval Strike Warfare Center, established to "focus on aviation tactical training effectiveness," stated, "We need to establish a strike/fighter mindset with attack and fighter attitudes."[6] Unfortunately, the fighter mindset and attitudes continue to dominate the strike fighter community. The near (0-5 years) to midterm (6-15 years) environments require the strike fighter community to fully embrace the defining role of the F/A-18, strike from the sea.[7] The change in mindset is not only crucial for the strike fighter community's combat operations with the F/A-18 but also for the introduction of JSF into conflicts.

A breakdown of past conflicts, the current environment, future trouble areas, and the emergence of hybrid warfare demonstrate the F/A-18's primary role as air-to-ground. The critical mission of the strike fighter community is attack from the sea including all facets of precision strike from Time Sensitive Targets (TST) to Close Air Support (CAS) to Maritime Air Strike (MAS) to Suppression of Enemy Air Defenses (SEAD). An examination of the training syllabi both in Unit Level Training (ULT) and the Inter Deployment Readiness Cycle (IDRC) illustrates an increasing importance in the air-to-ground mission post-Cold War. Although the training curriculum progressed more towards air-to-ground employment, the culture of the strike fighter community remained focused on air-to-air training in contrast to historically assigned combat missions and

near term to midterm threats. In order to be truly effective in future conflicts, the commitment to air-to-ground missions must be on par with the devotion given to air-to-air employment.

The air-to-air role will continue to be a crucial aspect for self-protection and power projection of carriers. The rise of peer competitors, proliferation of Russian and Chinese fighters, and advancements in air-to-air missiles demonstrates the importance of maintaining a substantial fighter syllabus. Additionally, air supremacy is a precursor to successful strike campaigns. The purpose of this paper is not to discount the importance of air-to-air training, or suggest a change to the training and readiness matrix (T&R) or IDRC, but rather examine the mission prioritization of the strike fighter community and suggest revisions on how to be more effective. Furthermore, the scope of the paper limits the discussion to F/A-18 squadrons that deploy with Carrier Strike Groups based in the United States. This excludes Unit Deployment Program Squadrons based in Japan.

The Post-Cold War Strike Fighter

An examination of the strike fighter's involvement in combat operations post-Cold War demonstrates a preponderance of air-to-ground missions. In Operation DESERT STORM, the epitome of conventional war, the F/A-18 led the bulk of Naval strike missions with 4,551 strikes, which accounted for the majority of the 29,000 general-purpose bombs dropped.[8] Operation DELIBERATE FORCE logged the F/A-18 an additional 182 strike missions over Bosnia-Herzegovina.[9] Operation DESERT FOX added another eighty-eight strike missions for the F/A-18.[10] The following year two F/A-18 squadrons and additional carrier-based squadrons flew 1700 strike missions and dropped 800 tons of ordnance during Operation ALLIED FORCE in Kosovo.[11] The

same squadrons dropped an additional 300 tons of ordnance in Iraq during Operation SOUTHERN WATCH.[12] Air-to-Air missions were important throughout the above-mentioned conflicts ensuring air supremacy but aerial combat was limited.

At the start of the Gulf War, the Iraqi Air Force consisted of over 700 fighter aircraft as part of the sixth largest air force in the world.[13] Coalition forces shot down forty-one Iraqi aircraft throughout the war with two shoot-downs attributed to Naval Aviation.[14] On 17 January 1991, a section of F/A-18s from the USS *Saratoga* shot down two MiG-21s, the first and only air-to-air kills for the F/A-18.[15] The subsequent two decades did not result in any air-to-air combat for either the F/A-18 or Naval Aviation writ large.

The Post 9/11 Strike Fighter

The Long War is approaching ten years of continuous conflict for Naval Aviation. Launched from the USS *Carl Vinson* and *Enterprise*, F/A-18s delivered the opening strikes of Operations ENDURING FREEDOM (OEF).[16] The weeks following 9/11 cemented the carrier's capability to project power vast distances inland. As RAND corporation noted in a study of OEF:

> Carrier-based Navy and Marine Corps strike fighters operating from stations in the North Arabian Sea substituted almost entirely for Air Force land-based fighter and attack aircraft because of an absence of suitable operating locations close enough to the war zone to make the large-scale use of the latter practicable.[17]

The opening salvos of OEF marked just the beginning of Naval Aviation's ongoing support of the Long War. The strike fighter community led the way with over 80,000 combat missions in support of Iraq and Afghanistan during which the F/A-18 delivered 24,000 precision-guided munitions.[18] The critical contribution of carrier-based

aviation remains evident today even with Air Force and Marine squadrons land based in Afghanistan. A single carrier on station in the Arabian Gulf provides 46% of fixed wing sorties in support of OEF with no likely pause in site.[19] With a continuous carrier presence in the Arabian Gulf/Indian Ocean for the "foreseeable future" and combat troops in Afghanistan until 2014, Naval Aviation will continue to support OEF in the near term.[20]

Future Conflicts and the Strike Fighter

Although it is difficult to predict future twenty-first century conflicts with accuracy, it is possible to assess potential areas of conflict or instability from which to assess the potential operating environment for naval strike aviation. An arc encompassing almost two thirds of the globe's nations encompasses a considerable amount of the world's problems. The area termed the "Arc of Instability" in military circles emphasizes the importance of the Navy and Marine Corps role in the Twenty-First Century. As General James Conway, former USMC commandant stated, "There's a lot of blue on that map of the arc of instability."[21] The "Arc of Instability" builds upon Thomas Barnett's work of depicting major military operations post 1990. Barnett's *New Pentagon Map* illustrated that major military operations (excluding humanitarian assistance) were confined to this region (or arc).[22] The Strategic Vision Group of the United States Marine Corps, which analyzes future security environments, identified forty-five potential insurgencies within the arc and similarly in projecting future operations for the next fifteen years almost all fall within the arc.[23]

The nature of conflict changed post 9/11. *Naval Operating Concept 2010* warns, "state and non-state adversaries are likely to employ a hybrid of conventional and

irregular methods to counter the United States' advantage in conventional military operations."[24] From the conventional standpoint, the role of anti-air combat in the next fifteen years will be extremely limited as Secretary Gates points out "nations may be unwilling to challenge the United States fighter to fighter."[25] A quick look at the proliferation of 4th generation fighters within the arc of instability demonstrates why. Within the arc roughly a quarter of the nations (29 countries) have 4th generation fighters. A single carrier has more 4th generation fighters than twenty-two of these twenty-nine countries. Out of those remaining seven countries the only with non-American fighters are Iran in the Middle East with forty MiG 29s (they also have 20 F-14As) and Kazakhstan and Uzbekistan in Central Asia (84 and 75, 4th generation fighters respectively). Egypt, Israel, Saudi Arabia, and Turkey all possess solely 4th generation American fighters; thus, American maintenance logistical support and associated expertise. For reference, North Korea, arguably the sole "threat nation" that lies outside of the arc of instability, maintains a modest forty MiG-29s.[26] Russia, India, and China continue to build advanced fighter aircraft as evident by the J-20 and T-50. The 2010 Quadrennial Defense Review assesses the likelihood of conventional conflict with these three nations as slim.[27] Furthermore, in the long-term (16+ years) as the fleet of 5th generation aircraft proliferates in Russia, India, and China, future air battles with UAS integration may very well be unrecognizable to the tactics and procedures currently employed. As Secretary Gates puts it, "air supremacy in this century, however, will almost certainly mean different things, and require different systems, personnel policies, and thinking than was the case for most of the Cold War."[28]

The emergence of hybrid warfare and technological advances allow small enemy

forces to have a disproportionate military strength compared to the size of the force. An example of hybrid conflict is the Second Lebanon War, where Hezbollah, a non-state actor, launched two C-802 anti-ship cruise missiles and three armed Unmanned Aerial Systems against Israel in 2006.[29] Nation states also increased unconventional capabilities to counter conventional strength. Iran conducted exercises with small boat swarm tactics in the Persian Gulf designed to entrap and destroy United States naval ships.[30] Similarly, South Korea's Defense Ministry recently stated "threats from North Korea's asymmetric warfare capabilities such as special forces, artillery pieces and weapons of mass destruction have been on a steady rise since 2008."[31] The rise of area denial and anti-access weapons further complicates the battle space. These weapons threaten air assets just the same as naval forces with advanced integrated air defense systems (IADS) and surface to air missiles (SAM) increasingly proliferated to smaller threat nations and non-state actors.

The proliferation of advanced SAMs increases the capability of threat nation states and non-state actors. The dominance of U.S. fighters, comparative inexpensive cost of missiles, and ability of advanced SAMs to threaten U.S. fighters led many threat countries to pursue the acquisition of advanced, "double digit" and "triple digit" SAMs. In Aviation Week, a senior government official stated, "The beginning of proliferation of double-digit SAMs is more of a concern than the potential air threats [such as Russia's Sukhoi Su-35 and China's Chengdu J-10] that are coming into service."[32] Recent reports of Iran attempting to acquire the formidable SA-20 and Syria gaining the SA-22 exemplify the threat.[33] Since the development of modern air defense systems, SAMs and Anti Aircraft Artillery (AAA) caused significantly more U.S. fighters losses than enemy

aircraft. In the Vietnam War, 70% of Navy's fixed wing losses came from surface fires while only 2% from enemy aircraft.[34] During Operation DESERT STORM, the Navy lost two aircraft to radar guided SAMs and two aircraft to AAA (1 unknown cause). The Coalition's sole air-to-air loss was a Navy F/A-18 shot down by a MiG-25. Enemy air defenses accounted for 31 coalition aircraft or 97% of the losses.[35] SAMs were also the major threat to U.S. aircraft in Bosnia and Kosovo. The trend of SAM proliferation will continue in future combat operations with enemy air defenses as the biggest threat to U.S. fighters.

As the nature of the enemy changes, the conduct of United States military operations will also change. Distributed operations will become the norm on the battlefield as evident in OEF and OIF. For example, a recent study by Massachusetts Institute of Technology states that one of the most important trends for Naval Aviation is "the evolution toward distributed air-ground operations ashore."[36] The study highlights the need for air assets to support distributed ground operations claiming a "major if not dominant mission" is " to detect and destroy" small concentrations of troops.[37] The strike fighter community will play a dominant role in future conflicts by providing this crucial support to lightly armed, mobile forces of the Army, Marines, and Special Forces.

The strike fighter's support of dispersed ground troops will continue to increase reliance on close air support (CAS). In Operation Desert Storm, CAS accounted for only 6% of the missions.[38] However, during the major combat operations of OIF, CAS accounted for over 75% of the Naval Aviation's involvement in the conflict.[39] Furthermore, CAS accounted for the vast majority of strike missions during phase IV operations in both OIF and OEF. As the Government Accountability Office (GAO)

found in their 2003 report, CAS was extremely critical in Afghanistan due to light ground forces relying solely on air for fire support.[40]

Carrier aviation will inevitably be at the forefront in future conflicts due to the lack of access to suitable military airfields across the world. This will increase the demand for carriers in future wars. There are few regions of the world that carrier-based aviation cannot strike with the sustained and operational reach of the F/A-18 coming in at 450 and 900 nautical miles respectively.[41] As Rear Admiral Terry Kraft, commander Carrier Strike Group Twelve, states, "current and future operations require aircraft to be there, on station, and responsive to asymmetric threats while being ready to attack moving ground targets. Ground forces, particularly troops in contact, need flexible, multi-role air power to respond immediately."[42] Strike, CAS, and Non-Traditional Intelligence Surveillance Reconnaissance (NTISR) missions will continue to be the dominant missions of the strike fighter community in the near term.

Current Strike Fighter Training

The training program for the F/A-18 reflects the multi-role capability of the aircraft with flights dedicated to both air-to-air and air-to-ground missions. In the 1990s, strike fighter training took a "pronounced swing toward ground-attack operations, with a predominant stress on day and night precision strike" in response to deficiencies in Operation DESERT STORM and retirement of the A-6.[43] In 1998, Strike Warfare (STW) accounted for 36% of all flight hours while 44% were Anti Air Warfare (AAW). The allocations of STW flight hours increased to 41% in 2000 with 39% going towards AAW.[44] The trend continued throughout the first decade of the Twenty-First Century. The sortie based readiness matrix from 2004 demonstrates an increasing importance on

STW with thirty STW sorties required for 100% readiness compared to twenty AAW within the ninety day periodicity.[45] Additionally, the number of CAS flights and laser guided bomb (LGB) flights increased in 2005, which added events that reflected ongoing combat operations.[46]

In 2009, Naval Aviation began transitioning towards a capabilities based readiness matrix (CBM) for training and readiness. The CBM "provides guidelines for preparing aircrew to perform the tasks required to support Joint and Combatant Commanders."[47] The CBM outlines a skill set that correlates to the capabilities "deemed critical for the mission accomplishment of a given squadron" or Naval Tactical Tasks (NTA).[48] The new CBM matrix highlights the importance of air-to-ground missions. The NTAs are almost identical for all variants of the F/A-18 with fifteen of sixteen being the same. A third of the fifteen NTAs are administrative type tasks (Move units, flight operations, launch aircraft, recover aircraft, and conduct in flight refueling). Out of the remaining ten tasks two are air-to-air essential tasks, Offensive Counter Air (OCA) and Defensive Counter Air (DCA). The remaining eight NTAs are air-to-ground specific. These eight critical capabilities are to perform tactical reconnaissance, perform area reconnaissance, attack surface targets, attack enemy land targets, suppress enemy air defenses (SEAD), interdict enemy operations and forces, conduct fire support (CAS), and perform combat search and rescue (CSAR). The F/A-18C adds an additional NTA of mine operations, while the F/A-18F includes organizing fire support assets or Forward Air Controllers Airborne (FAC A).[49]

The IDRC also focused more effort in the air-to-ground domain and on specific skill sets that are required more frequently in combat operations. An example is the

Strike Fighter Advanced Readiness Program (SFARP), the pinnacle of ULT for a deploying squadron. SFARP added a CAS, Special Operating Forces integration, and precision guided bomb flights to the syllabus over the past ten years. Strafing flights increased as well with four events dedicated to air-to-ground bullet attacks in 2010 compared to zero ten years earlier.[50] Air Wing Fallon, the portion of the IDRC where the air wing's collective training is put to the test through combined large force exercises, also increased the air-to-ground training throughout its four week syllabus with specific emphasis on skills required in the current operating environments.[51]

Overall, the current training trends align with the Defense Science Board Task Force 2002's recommendation that strike fighter training gear more towards air-to-ground than air-to-air.[52] The effectiveness of the training hinges on the amount of effort attributed to the air-to-ground missions, which is a direct reflection of the culture in the strike fighter community.

The Current Strike Fighter Culture

The largest factor hindering the strike fighter community's effectiveness in the near term to midterm conflicts is mission prioritization, which largely favors air-to-air employment. The focus on air-to-air employment stemmed from Naval Aviation's air-to-air kill ratio during the early stages of the air war over Vietnam. The ratio diminished from a ten to one ratio, the historical average from past wars, to a two to one ratio versus Vietnamese MiGs.[53] During a halt in the air war, the Navy created TOPGUN, the "graduate school for dogfighting."[54] Once the air war continued, "the post-Top Gun Navy kill ratio closed at twelve to one."[55] Since the Vietnam War, the Navy continuously trained to the basic fighter maneuvers (BFM) mission, which is "the first

time in American history that war-level dogfight practice has been maintained steadily after hostilities have ceased."[56]

The development of TOPGUN illustrated the conflicts between air-to-air and air-to-ground prioritization. The initial syllabus for TOPGUN was a four week course with three weeks of air-to-air and one week of "air-to-mud, a bombing segment", which many of the instructors opposed.[57] Even the sole air-to-ground instructor, John Nash, was "upset that he wasn't teaching ACM at the school." (Air Combat Maneuvers, also known as BFM) Mr. Nash explained the instructors teaching ACM were not better than him but he was the only one who could teach the air-to-ground syllabus.[58]

Through the 1980's, the F-14 Tomcat dominated Naval Aviation's culture. The attack communities, A-7 and A-6, roles were important but "the fighter guys were at the very tip of the pyramid."[59] The blockbuster hit of *Top Gun* solidified this culture, and the actual TOPGUN "evolved into a whole curriculum of air combat courses."[60] Even the introduction of the F/A-18 multi-role aircraft did little to change the culture as evident in military photographer George Hall's comment on the designation of the new aircraft:

> In the rarified fighter world the dual-role Hornet is never referred to by its official F/A-18 designation, and fighter jocks suppress involuntary shudders at the mere thought of rearranging the earth's surface by the undignified dropping of explosive ordnance.[61]

At the start of the Operation DESERT STORM, Naval Aviation with limited capabilities to operate in the littoral area found itself on the verge of irrelevance after decades preparing for an open ocean conflict.[62] As a RAND noted, "Naval aviation performed admirably in Desert Storm only because of its inherent professionalism and adaptability, not because its doctrine and weapons complement were appropriate to the

situation."[63] Significant shortfalls threatened to minimize the role of Naval Aviation in future littoral and land conflicts.

The lessons learned in the war drove Naval Aviation and the strike fighter community to change following Operation DESERT STORM. Again, RAND notes, "the Navy substantially upgraded its precision-strike capability by fielding new systems and adding improvements to existing platforms."[64] One major change was the modification of the F-14 with a sophisticated targeting pod giving the fighter a substantial air-to-ground role. The conversion of the F-14 into a fighter attack platform multiplied the strike assets of the strike fighter community but it seemed to have little effect on the culture.

In 1998, New York Times published an article highlighting the overarching air-to-air culture titled "Status is ... for Navy Fighter Pilots; An Air-to-Air Kill." The article recapped the last air-to-air kill, during Operation DESERT STORM, by then-Lieutenant Commander Nicholas Mongillo, who states, "A fighter pilot needs an air-to-air kill. It's something every fighter pilot wants." The article quotes a F/A-18 aviator who flew twenty-eight combat missions and dropped ordnance on targets but was disappointed he did not have the "opportunity to engage anybody." As summed up by another pilot, "The biggest status symbol for us comes when you shoot down the enemy."[65]

In 1999, F/A-18s and F-14s played a significant role in the air campaign during Operation ALLIED FORCE. The subsequent reports, however, call into question whether the respective communities embraced the air-to-ground role. The After Action Report to Congress found that during Operation ALLIED FORCE, Navy pilots were not adequately prepared for the mission of "locating targets, while minimizing collateral

damage."[66] Furthermore, Naval Aircraft experienced high miss rates in the opening days of the Kosovo War.[67] A contributing factor for the misses was that "U.S. Navy pilots hadn't been trained in using laser-guided weapons", requiring instructors to be sent to the carrier.[68]

The performance of the strike fighter community in the subsequent two wars, OEF and OIF, largely dispelled the criticism that Naval Aviation was unable to "project credible and sustained power."[69] As stated previously, increase in the strike fighter community with the addition of the F-14, acquisition of precision weapons, and more air-to-ground training led to successes on the battlefield representing "a quantum improvement over the Navy's performance in Desert Storm, when only the A-6E had an autonomous precision-attack capability."[70] The success of the past ten years not withstanding, the culture of the strike fighter community remained centered around air-to-air employment. For instance, during the beginning stages of OEF, strike fighter aircrew often focused on the air-to-air rules of engagement (ROE) over the air-to-ground ROE. The lack of emphasis on air-to-ground ROE resulted in degraded CAS and TST capabilities.[71] The examination of two key programs will further illustrate this emphasis on air-to-air: the Strike Fighter Instructors Course (TOPGUN) and the Strike Fighter Weapons and Tactics Program (SFWT).

TOPGUN is widely regarded as one of, if not the most elite fighter training evolution in the world. TOPGUN is the coup de tat of the strike fighter community and only the aviators with the highest performance marks receive the invitation to attend the course. Throughout strike fighter squadrons, the TOPGUN manual is the bible, "TOPGUN recommends..." is the gospel, and Strike Fighter Instructors (SFTI) are the

disciples ensuring that "tactics information is disseminated to squadron personnel in a timely manner."[72] From tactical development, standardization, and evaluation, TOPGUN plays a major role in shaping the mission prioritization of the strike fighter community. Graduates of TOPGUN are designated SFTIs and slated to a variety of positions but the bulk are assigned to one of the Weapons Schools (Atlantic and Pacific) with a selective few remaining on staff at TOPGUN as instructors. These two billets correspond to SFWT Level V Instructors, current Weapons School SFTIs or TOPGUN SFTIs.[73] After the initial tour, SFTIs return to an operational squadron as Training Officers managing the SFWT program and assessing squadron tactical proficiency.[74]

The TOPGUN course, as stated previously, began as mix of air to air (75%) and air to ground flight (25%), however, throughout the 1980s transitioned solely to an air to air syllabus with over thirty ACM flights over a five week course.[75] "Once the F/A-18 multirole fighter began arriving in the Navy's air wings, however, the scope of training concern at TOPGUN was expanded to include ground-attack operations."[76] The recent discussion of a sequel to the 1986 film *Top Gun* even had Jerry Bruckheimer weighing in that "the aviation community has completely changed since we made the movie a long time ago."[77] Further speculation highlighted a common misconception: "the TOPGUN syllabus has been changed so the focus is far less on the spectacular and dramatic air-to-air dogfights that defined *Top Gun* and far more about teaching U.S. pilots to drop very large bombs on very small ground targets."[78] The actual syllabus at TOPGUN does not reflect this change as the majority of the syllabus focuses on air-to-air missions. The air-to-ground phase consists of six flights, which is the same amount of flights dedicated to the BFM phase. The number of scheduled flights is not an accurate indicator of

prioritization since a TOPGUN student must pass each flight to continue with the syllabus. The number of "reflys" is based on the student's performance with three attempts being the average to complete a single event for the BFM phase.[79] The BFM phase often then takes considerably more time and flights due to "reflys" than the air-to-ground phase

Marine Corps aviators attending TOPGUN illustrate another example of the emphasis on air-to-air. In 2008, the new T&R matrix for the USMC F/A-18 eliminated the Air Combat Tactics Instructor (ACTI) syllabus. The loss of ACTI coupled with the loss of the Marine Division Tactics Course (MDTC) in 2004 decreased air-to-air proficiency across the community.[80] The shift in mission prioritization proved disastrous for Marine Corps aviators attending TOPGUN resulting in a string of failures.[81] In an effort to rebuild air-to-air proficiency the Marine Corps brought back the MDTC in June 2010.

The SFWT program began in 1995 to standardize tactics among squadrons and increase aircrew knowledge. The SFWT program consists of five tiered levels representing significant milestones in aircrew's tactical and professional development.[82] The completion of the SFWT Level III syllabus is the capstone event of the aviator's first tour, designating the candidate capable of tactical employment of a section and normally corresponding with a section lead designation (ability to lead two aircraft into combat).[83] The SFWT Level III syllabus requires the candidates to brief and lead ten simulators and eighteen flights coupled with academics.[84] This syllabus requires the most effort, dedication, and time out of the aviator's first operational tour. Once complete the "individual is capable of performing all core missions that pertain to section

employment."[85]

A breakdown of the Level III flights (excluding the standardization evaluation flight) depicts more flights dedicated towards air-to-air, which comprises 65% of the syllabus with five BFM, four Intercept, and two Red Air flights.[86] The flight syllabus virtually remained unchanged for eleven years until the addition of an Armed Recce/Urban CAS flight in late 2010, doubling the CAS flights in the syllabus.[87] The two CAS/NTISR flights account for 12% of the syllabus but the vast majority of combat operations flown over the past ten years. The syllabus includes only one SACT flight (a simulator event is also dedicated to SACT). Surface fires are the single largest cause of Naval Aviation combat losses (over 75%) since the advent of modern SAMs.[88] The sole SACT flight in the syllabus accounts for 5%, while the BFM portion accounts for 30% of the syllabus and encompasses less than 2% of historical combat losses.[89]

A significant portion of the Level III syllabus is the BFM phase consisting of five flights.[90] The emphasis on BFM in the SFWT is part of the culture of the strike fighter community. SFWT Level III candidates arguably spend more time preparing, briefing and debriefing BFM flights than any other flight in the syllabus (except the standardization evaluation flight). Similar to the TOPGUN course, BFM flights often require "reflys" because of unsatisfactory performance. A further example of BFM prioritization is the "snapshot drill," where aircrew spend a significant amount of time and effort in the debrief determining if the "fleeting bullet shot" hit the opposing fighter. By itself this is the level of detail that makes Naval Aviation great, however, once compared to a debrief of an air-to-ground strafe, which is a far more likely scenario, the former debrief normally is more standardized and detailed. BFM flights also require a

SFWT Level V SFTI (or squadron SFTI if Level V unavailable) to instruct and debrief a flight, while that level of instruction is only advised for the other phases of the syllabus.[91]

Air-to-Air continues to dominate the strike fighter culture illustrated in part by the emphasis on "dogfighting." BFM is undoubtedly a necessary skill set, but the amount of effort put into the brief, flight(s), and debrief far outweighs the likelihood of a modern day dogfight. A rough analogy to ground forces would be the following scenario: Two ground combatants face off against each other at a considerable distance and begin to exchange shots with their long range rifles. A long-range shot with any weapon is inherently difficult so it is conceivable that the shots could miss. As the two combatants begin to close range and acquire each other visually, they break out their 9mm and continue shooting. The likelihood of this scenario decreases as the combatants perform "*Matrix*-like" defenses to defeat the 9mm bullets, then pull out their knives, and get into a wrestling match. The ground forces thus dedicate 25% of their training to wrestling. The above example is not to discount BFM as a critical part of the T&R matrix. BFM is a necessary skill set not only as a tactical contingency but also as a building block to teach aviators to push and understand performance levels of the aircraft. The effort, dedication, and time placed into the brief, flight, "reflys," and debrief exceeds any other portion of the respective syllabi. Arguably the most crucial portion of a junior officer's professional development revolves around air-to-air training reminiscent of the skies over Hanoi.

Recommendations for the Strike Fighter Community

The focus on air-to-air remains ingrained in the culture of the strike fighter community. Secretary Gates recently stated the Air Force's air-to-air combat community "so dominated the service leadership and organizational culture that other critical

missions and new capabilities have been subordinated and neglected." A similar situation challenges the Navy. TOPGUN and the SFWT syllabi create a culture where greater emphasis placed on air-to-air directly contrasts the critical NTAs assigned and overall delineation of the T&R matrix. SFTIs ingrained with air-to-air during TOPGUN impart this air-to-air centric mindset to the operational fleet as training officers. The prioritization of air-to-air missions subsequently defines the amount of effort a Level III candidate places on the respective portions of the syllabus. A TOPGUN syllabus more closely reflecting the multi-role capability of the F/A-18 will ensure that the "graduate level" program reflects the full spectrum of operations and ultimately will balance the underlying culture of the strike fighter community. Additionally, a revision to the SFWT syllabus incorporating robust air-to-ground flights will more accurately reflect the operating environment and better prepare aircrew for current and future conflicts.

The increased emphasis on air-to-ground missions in the T&R matrix and IDRC undoubtedly helped aircrew prepare for combat missions but there is room for improvement. CAS gained attention after Operation Anaconda highlighted concerns over close air support in a joint environment culminating in a GAO report in 2003. The GAO report on CAS concluded all services had limited success in overcoming the barriers that prevent realistic training to support joint operations. The GAO found four lingering reasons for the deficiencies: limited joint training, unrealistic training, differing standards for joint terminal air controllers (JTAC), and low priority to the mission.[92] The report spurred significant progress over the past seven years including standardization across the services, introduction of joint publications, and higher prioritization of CAS missions. Lack of joint integration, however, still hampers the effort. One example is the

continued reliance on voice communications for CAS missions in OEF. The joint community largely solved the interoperability issues across the services since the report highlighted the problems.[93] The F/A-18 is equipped with digital CAS, which aircrew train to use both Link-16 and variable message format. The ability to operate the system between like aircraft is rather straightforward, the difficulty arises when setting up and managing the system to operate with both joint aircraft and JTACs. Without the benefit of Joint CAS training, aircrew are often unable to use digital CAS during combat operations and thus regress to intensive voice communications.

Joint CAS training is by far the exception rather than the norm. The vast majority of CAS training outside of the IDRC is supported by F/A-18 FAC(A)s often simulating ground JTACs. Occasionally, Navy Special Warfare CAS Terminal Controller's Course or Marine Corps Forward Air Controllers support CAS missions. Interaction with Army Fire Observers and Air Force JTACS, however, is practically non-existent even with numerous opportunities for Joint CAS training. The Marine Corps recently turned to contract CAS provided by a private company to fill the void of military aircraft.[94] Joint CAS exercises such as Green Flag and Atlantic Strike provide realistic training incorporating JTACs, Fire Observers, UASs, and manned air assets from across the services. In 2009, a Commanding Officer of a strike fighter squadron commented in a press release that Green Flag was "the best pre-deployment training" and it was "just like a no-kidding deployment."[95]

The CAS mission is not the only area for improvement. Maritime Air Strike (MAS) is also a neglected mission even though strikes against surface platforms have been more common than air-to-air combat over the past twenty years. From the

conventional standpoint both Operation DESERT STORM and OIF produced F/A-18 strikes against enemy naval targets. On the unconventional side, a F/A-18 executed a show of force over a "swarm" of suspected Iranian boats in 2006 and in February 2011, a F/A-18 strafed a pirate mothership in the Arabian Gulf.[96] As the oceans become increasingly attested, the F/A-18 brings a critical capability to the Navy's arsenal. TOPGUN acknowledged the importance of MAS dedicating an expert to tactics development in 2010. In March 2011 Secretary Gates stated "the most plausible high end scenarios for the U.S. military are primarily naval and air engagements" highlighting the importance of MAS for the strike fighter community.[97]

In order to prepare for operations under the umbrella of SAM systems air-to-ground flights must include SACT at every possible opportunity during ULT. During air-to-air missions, aircrews routinely refine missile defense skills often dedicating entire flights to the defensive maneuvers as partial task trainers. From the air-to-ground perspective, strike fighter training rarely incorporates SACT outside of the IDRC even though modern SAMs and AAA account for the vast majority of combat losses.

Beyond missions, new capabilities continue to upgrade the strike fighter community requiring integration into air-to-ground training. Raytheon delivered the 250th Advanced Electronic Scanned Array (AESA) radar in March 2011. The AESA "revolutionized fighter combat capabilities" not only for host Super Hornet platforms (F/A-18 E/F) but also for the entire air wing team with Link 16 integration.[98] AESA is also a game changer in the air-to-ground arena bringing increased lethality. AESA tracks moving targets on the land and sea and overlays the contacts on a synthetic aperture radar (SAR) map. The sea mode of the AESA remains an immature function of the radar but

future capabilities look promising. Additionally, SAR maps provide the ability to produce GPS quality coordinates in all weather conditions and from greater standoff systems distances. The AESA radar is a critical capability for future conflicts when weather prevents other acquisition methods. The F/A-18 with AESA is an organic all weather TST and CAS platform.

The integration of UASs is essential for future operations. UASs are a crucial part of the battlefield and the demand is increasing. The Air Force conducts forty-eight combat air patrols with Predators and Reapers with F-15Es already having the ability to receive live feeds from UASs.[99] Current F/A-18 air-to-ground missions would greatly benefit from UAS feeds, adding improved situation awareness, collateral damage estimates, and hostile identification methods. UASs will also play a large role in the maritime environment with the introduction of Broad Area Maritime Surveillance (BAMS) UAS. The Navy Unmanned Combat Air System (UCAS-D) carrier demonstration also recently reached a milestone with the first flight of the X-47B. The X-47B flight "represents the beginning of unmanned tactical aircraft for the Navy."[100] The UCAS-D opens carrier decks to unmanned aircraft and integration with strike fighters is crucial to not only current combat operations but also to the path for future tactics.

Conclusion

Strike fighter training largely reflects the multi-mission capability of the F/A-18. The T&R matrix and IDRC syllabi demonstrate the importance of both air-to-air and air-to-ground missions. The gradual shift in training towards air-to-ground missions reflects historical lessons, current conflicts, and potential future wars. The CBM (the new T&R

matrix) highlights the attack role of the F/A-18 with 80% of the combat related core missions being air-to-ground. The training also includes the critical air-to-air skills, which are necessary for future conflicts to maintain air superiority in the maritime and littoral environment. The current delineation between air-to-air and air-to-ground missions in the training program maintains balance allowing strike fighter aircrew to prepare across the full spectrum of conflict. The CBM of the F/A-18 and its associated reports provide a "snapshot" of a given F/A-18 squadron. The matrix balances the multi-mission capabilities of the F/A-18 and provides a framework to prepare for missions across the full-spectrum. The training and readiness matrix and IDRC syllabi does not capture the entire picture of the strike fighter community. Mission prioritization and the underlying culture of air-to-air detract from the effectiveness of the F/A-18.

The difference between the "what" and "how" of the training is where the strike fighter community places its priorities. Naval Aviation, understandably, does not want to repeat the lessons learned from the Vietnam War where a "peasant air force" often humiliated naval fighters. The creation of TOPGUN reversed the trend and instilled superiority in the air-to-air arena. Air-to-Air training must continue to be a staple in the strike fighter community but the effort given should be equal to that of the air-to-ground missions. The incorporation of air-to-ground flights that match the complexity of the air-to-air events of TOPGUN and SFWT will go a long way in changing the collective mindset of the strike fighter community. Furthermore, minor revisions incorporating joint CAS, MAS, UAS integration, and robust SACT into training will better prepare strike fighter aircrew for future battlefields.

Over the past 100 years, Naval Aviation was a mainstay of combat operations and

the future will continue to demonstrate the versatility of carrier-based aviation. The strike fighter community provides a vital capability due to its ability to launch from forward deployed carriers and project power vast distances to future hotspots within days if not hours of orders. Future missions will likely be a mixture of strikes from pre-planned LFS, TST, MAS, to CAS. Mobile target sets, concealed and camouflaged targets, and collateral damage concerns, will complicate the target environment requiring mastery and a firm grasp of air-to-ground skills. UASs will increasingly play a larger role and integration is necessary for future battlefields. The underlying threat to the strike fighter community will be advanced SAM systems, which are being proliferated to smaller threat nations and non-state actors. In order to stay relevant, effective, and lethal in future conflicts the strike fighter community must ensure a dedication to air-to-ground missions that equals air-to-air missions. The near term and midterm operating environments demonstrate the majority of missions will fall under the domain of air-to-ground, necessitating a greater emphasis on the attack portion of missions and driving the strike fighter community's collective mindset more towards the "A" of the "F/A-18".

Notes

[1] Benjamin S. Lambeth, *American Carrier Airpower At the Dawn of a New Century.* (Santa Monica: RAND, 2005), 102.
[2] David Rogers and Jen Dimascio, "Senate votes to cut F-22 fighter jet funding." *Politico.com,* July 21, 2009. http://www.politico.com/news/stories/0709/25210.html (accessed October 15, 2010).
[3] "Pentagon Cuts $6.9 Billion From JSF Procurement Over Five Years." *Inside the Pentagon,* January 27, 2011. (www.insidedefense.com)
[4] D.J. Harris, "Jack of all trades, master of none. " *United States Naval Institute. Proceedings*, March 2002. http://www.proquest.com/.
[5] Robert M. Gates, "United States Air Force Academy Speech." *Defense.gov*, March 4, 2011. http://www.defense.gov/transcripts/transcript.aspx?transcriptid=4779 (accessed March 4, 2011)
[6] Rick Llinares, "Naval Aviation's premier training ground: Naval Strike and Air Warfare Center." *Naval Aviation News,* March 1, 2002. http://www.thefreelibrary.com/ /print/PrintArticle.aspx?id=108548247 (assessed Nov 15, 2010)
[7] *Naval Aviation Vision 2010.* (Washington, D.C.: U.S. Navy, Naval Aviation Enterprise, 2010), 91.
[8] *Gulf War Air Power Survey. Volume 5. A Statistical Compendium and Chronology.* Ft. Belvoir: Defense Technical Information Center, 1993. 418.
[9] Robert C. Owen, *Deliberate force a case study in effective air campaigning : final report of the Air University Balkans air campaign study.* (Maxwell AFB, Ala.: Air University Press, 2000), 217.
[10] Official websites of VFA-37 and VMFA-312. http://www.vfa37.navy.mil/ http://www.usmc.mil/unit/2ndMAW/mag31/vmfa312/Pages/history.aspx (accessed November 15, 2010).
[11] Prina L. Edgar, "Air war Kosovo: Lessons learned and relearned. " *Sea Power,* November 1999. http://www.proquest.com/.
[12] Ibid.
[13] *Gulf War Air Power Survey*, 18.
[14] *Gulf War Air Power Survey*, 654.
[15] *Gulf War Air Power Survey*, 653.
[16] House Committee on Armed Services, Seapower and Expeditionary Forces Subcommittee. *Budget Request For Department Of The Navy Aviation Programs: Hearing before Seapower and Expeditionary Forces Subcommittee.,* 111th Cong., 1st sess., May 19, 2009, 9.
[17] Lambeth, Ix.
[18] House Committee on Armed Services, Seapower and Expeditionary Forces Subcommittee, 53.
[19] Ibid, 9.
[20] Elizabeth Bumiller, "U.S. Tweaks Message on Troops in Afghanistan." *NYTimes.com,* November 10, 2010.http://www.nytimes.com/2010/11/11/world/asia/11military.html?scp=1&sq=tweaks%20afghanistan&st=cse (accessed November 15, 2010). *Naval operations concept 2010 implementing the maritime strategy.* Washington, D.C.: Dept. of the Navy, 2010. 30.
[21] Department of Defense. "DOD News Briefing with Gen. Conway from the Pentagon". Transcript. http://www.defense.gov/Transcripts/Transcript.aspx?TranscriptID=4676. (accessed November 15, 2010)
[22] Thomas P.M. Barnett, *The Pentagon's New Map: War and Peace in the Twenty-First Century.* Map. http://globlogization.wikistrat.com/high-resolution-map. (Accessed November 15, 2010).
[23] Strategic Visions Group, USMC. "Patterns, Trends and Future Force Implications." Brief. http://www.quantico.usmc.mil/download.aspx?Path=./Uploads/Files/SVG_Future%20Warfare%20Brief%20APL-JHU%202%20April%2009-no%20notes%20or%20backups.ppt (accessed Oct 25, 2010)
[24] *Naval operations concept 2010,* 7.
[25] Robert M. Gates, "A Balanced Strategy: Reprogramming the Pentagon for a New Age." *Foreign Affairs.com.* http://www.foreignaffairs.com/articles/63717/robert-m-gates/a-balanced-strategy (accessed September 20, 2010).
[26] Aviation Week. *Aerospace Source Book 2009.* Available online at http://www.aviationweek.com/aw/sourcebook/channelSB_profiles_military.jsp?channelName=mi. (accessed Nov 14, 2010).
[27] *Quadrennial Defense Review Report.* (S.l.: Quadrennial Defense Review, 2010), 57-60.

[28] Gates, "United States Air Force Academy Speech."
[29] Michael W. Isherwood, *Airpower for hybrid warfare.* (Washington, DC: Mitchell Institute Press, 2009), 8-9. P. W Singer, *Wired for war: the robotics revolution and conflict in the twenty-first century.* (New York: Penguin Press, 2009), 264.
[30] Fariborz Haghshenass,"Iran's Doctrine of Asymmetric Naval Warfare." PolicyWatch #1179, *WashingtonInstitue.org*, December 21, 2006.
http://www.washingtoninstitute.org/templateC05.php?CID=2548
[31] UPI. "S. Korea issues paper on N. Korea's military." *UPI.com*, December 30, 2010.
http://www.upi.com/Top_News/World-News/2010/12/30/S-Korea-issues-paper-on-N-Korea-military/UPI-85401293714514/ (accessed Jan 3, 2010).
[32] David A. Fulghum, "Russia Sells SA-20 to Iran." *Aviationweek.com*, December 12, 2008.
http://www.aviationweek.com/aw/generic/story_generic.jsp?channel=awst&id=news/aw121508p2.xml&headline=null&prev=10. (accessed December 3, 2010).
[33] Ibid.
[34] *Blue Jacket Manual*, "USN/USMC Fixed Wing Aviation Southeast Asia Statistical Summary 1962 – 1973." *Bluejacket.com*. http://bluejacket.com/usn-usmc_stats_seasia.html#area%20of%20damage (accessed December 02, 2010).
[35] *Gulf War Air Power Survey*, 641.
[36] Owen R. Cote, *The future of naval aviation.* (Cambridge, Mass.: Massachusetts Institute of Technology, Security Studies Program, 2006), 24.
[37] Ibid.
[38] Rebecca Grant, "The clash about CAS. " *Air Force Magazine*, January 2000. http://www.proquest.com/.
[39] Arthur Jr. Brill, "Close Air Support: More Improvements Are Needed." *Seapower*. November 2003. http://www.navyleague.org/sea_power/nov_03_15.php. (assessed Nov 21, 2010).
[40] United States Government Accounting Office. Report to the Ranking Minority Members, Subcommittees on Total Force and Readiness, Committee on Armed Services, House of Representatives. *MILITARY READINESS Lingering Training and Equipment Issues Hamper Air Support of Ground Forces.* Washington, DC: GAO, 2003, 2.
[41] *Naval Aviation Vision 2010*. Washington, D.C.: U.S. Navy, Naval Aviation Enterprise, 2010. 7
[42] Terry B. Kraft, *"It Takes a Carrier: Naval Aviation and the Hybrid Fight." Proceedings*, Vol. 135, Iss. 9,Sep 2009. http://www.proquest.com/
[43] Benjamin S. Lambeth, *Combat pair the evolution of Air Force-Navy integration in strike warfare.* (Santa Monica: RAND, 2007), 21.
[44], John F. Schank, *Finding the Right Balance: Simulator and Live Training for Navy Units.* (Santa Monica, CA: Rand, 2002), 94.
[45] Commander of Naval Air Forces. *Squadron Training and Readiness. CNAFINST 3500.1B. September 21, 2004. Encl 5.*
[46] Commander of Naval Air Forces. *Squadron Training and Readiness. CNAFINST 3500.1B Change 1. August 12, 2005. Encl 1.*
Commander of Naval Air Forces. *FA-18 A-F Combined Wing Training Manual.* CSFWPINST 3500.7C. November 5, 2008. 2.
[48] Ibid. Chief of Naval Operations. *Universal Naval Task List.* OPNAVINST 3500.38B. Version 3.0. January 30, 2007. 2-1.
[49] Commander of Naval Air Forces. *3500.1C T&R Matrices.* Encl 1 VFA Training Matrix. August 5, 2010.
[50] SFARP Evolution compiled from various sources (flight schedules, syllabi, instructions…etc) in print and electronic form from hard drives, zip drives and CD-ROMs at SFWSP. LCDR "Lick" Kihm spent countless hours constructing the spreadsheet delineating the evolution of SFARP over the past ten years.
[51] Rick Llinares, "Naval Aviation's premier training ground: Naval Strike and Air Warfare Center." *Naval Aviation News*, March 1, 2002.
http://www.thefreelibrary.com/Naval+Aviation's+premier+training+ground%3A+Naval+Strike+and+Air...-a0108548247 (accessed Nov 15, 2010).
[52] *Defense Science Board Task Force on Future of the Aircraft Carrier* . Washington, D.C.: Office of the

Under Secretary of Defense For Acquisition, Technology, and Logistics, 2002. 20.
[53] Robert K. Wilcox, *Scream of eagles: the creation of Top Gun and the U.S. air victory in Vietnam.* (New York: J. Wiley, 1996), 47.
[54] Ibid,116.
[55] Ibid, 290.
[56] Ibid, 291.
[57] Ibid, 145.
[58] Ibid, 122.
[59] George Hall, *Top Gun: the Navy's Fighter Weapons School.* (Novato, CA: Presidio Press, 1987), 34.
[60] Ibid, 7.
[61] Ibid, 34.
[62] Lambeth, 2.
[63] Ibid.
[64] Ibid, 3.
[65] Matthew Klam, "Status is ... for Navy Fighter Pilots; An Air-to-Air Kill." *NYTIMES.COM,* November 15, 1998. http://www.nytimes.com/1998/11/15/magazine/status-is-for-navy-fighter-pilots-an-air-to-air-kill.html (accessed Oct 20, 2010)
[66] *Report to Congress Kosovo/Operation Allied Force after-action report.* (Washington, D.C.: Dept. of Defense, 2000), 117.
[67] Paul Ciotti, "Clinton's War on the Navy". *WorldNetDaily.* http://www.wnd.com/index.php?fa=PAGE.printable&pageId=4039. (assessed Nov 30, 2010)
[68] Ibid.
[69] Lambeth, 100.
[70] Lambeth, 32.
[71] David D. Kindley, "Why Won't You Drop Damn You." *Joint Military Operation's Thesis.* (Naval War College, 2004), 5.
[72] Commander of Naval Air Forces. *Strike Fighter Weapons and Tactics (SFWT) Program.* CSFWPINST/CSFWLINST 1525.1E. March 31, 2010. 10.
[73] Ibid, Enclosure-1, 4.
[74] Ibid, 10.
[75] Hall, 7.
[76] Lambeth, *Combat Pair.* 24.
[77]Claude Brodesser-Akner, "Top Gun 2 Is Heading to the Runway." *NyMag.com.* http://nymag.com/daily/entertainment/2010/10/top_gun_2.html (accessed Oct 25, 2010)
[78] Ibid.
[79] LT Dallas "Gomer" Jamison, N7 TOPGUN, email message to author, December 14, 2010. instructors
[80] Maj Elika "Peepers" Bower, MAWTS, email message to author, October 10, 2010.
[81] Maj Elika "Peepers" Bower, MAWTS, email message to author, October 10, 2010.
[82] CSFWPINST/CSFWLINST 1525.1E, 1-2.
[83] Ibid, 3-5.
[84] Commander of Naval Air Forces. *Strike Fighter Weapons & Tactics (SFWT) Briefing Guide.* July 2010. v.
[85]CSFWPINST/CSFWLINST 1525.1E, Enclosure-1, 1.
[86] *SFWT Briefing Guide*, v.
[87] Commander of Naval Air Forces. *Strike Fighter Weapons and Tactics (SFWT) Program.* CSFWPINST/CSFWLINST 1525.1C-E. December 1999 through March 31, 2010.
[88] *Blue Jacket Manual. Gulf War Air Power Survey*, 641.
[89]*SFWT Briefing Guide*, v.
[90] Ibid.
[91] CSFWPINST/CSFWLINST 1525.1E, Enclosure-1, 2.
[92] United States Government Accounting Office, 2.
[93] Ibid, 19.
[94] ATAC Press Release, "US Marine Corps Successfully Employs Contracted Air to Ground Training Capability." *PRNEWSWIRE.COM.* http://www.prnewswire.com/news-releases/us-marine-corps-successfully-employs-contracted-air-to-ground-training-capability-95760919.html (assessed Oct 20, 2010)

[95] Casey E. Bain, "Joint warfighters hone close air support skills at JRTC." JFIIT, USJFCOM. http://www.jfcom.mil/newslink/storyarchive/2009/pa100609.html (accessed Nov 15, 2010)

[96] CVW-8 Deployment Aug 2005-March 2006, CVW-17 Deployment Dec 2010 – TBD.

[97] Robert M. Gates, "United States Military Academy Speech." *Defense.gov*, February 25, 2011 http://www.defense.gov/speeches/speech.aspx?speechid=1539 (accessed March 4, 2011)

[98] Raytheon Press Release, "Raytheon Delivers 250th APG-79 AESA Radar." *PRNEWSWIRE.COM.* http://www.prnewswire.com/news-releases/raytheon-delivers-250th-apg-79-aesa-radar-117231438.html (asessed March 4, 2011).

[99] Gates, "United States Air Force Academy Speech."

[100] Guy Norris, "X-47B Sorties Ramping Up." Aviationweek.com, Feb 16, 2011. http://www.aviationweek.com/aw/generic/story_generic.jsp?channel=awst&id=news/awst/2011/02/14/AW_02_14_2011_p28-288506.xml&headline=X-47B%20Sorties%20Ramping%20Up (assessed March 5, 2011)

Bibliography

ATAC Press Release. "US Marine Corps Successfully Employs Contracted Air to Ground Training Capability." *PRNEWSWIRE.COM.* http://www.prnewswire.com/news-releases/us-marine-corps-successfully-employs-contracted-air-to-ground-training-capability-95760919.html (assessed Oct 20, 2010)

Aviation Week. *Aerospace Source Book 2009.* http://www.aviationweek.com/aw/sourcebook/channelSB_profiles_military.jsp?channelName=mi. (Accessed Nov 14, 2010).

Bain, Casey E. "Joint warfighters hone close air support skills at JRTC." JFIIT, USJFCOM. http://www.jfcom.mil/newslink/storyarchive/2009/pa100609.html (assessed Nov 15, 2010)

Barnett, Thomas P.M. *The Pentagon's New Map.* New York: G.P. Putnam's Sons, 2004.

Blue Jacket Manual. "USN/USMC Fixed Wing Aviation Southeast Asia Statistical Summary 1962 – 1973." Bluejacket.com. http://bluejacket.com/usn-usmc_stats_seasia.html#area%20of%20damage (accessed December 02, 2010).

Brill, Arthur Jr. Close Air Support: More Improvements Are Needed. *Seapower.* November 2003. http://www.navyleague.org/sea_power/nov_03_15.php. (assessed Nov 21, 2010).

Brodesser-Akner, Claude. Top Gun 2 Is Heading to the Runway. *NyMag.com.* http://nymag.com/daily/entertainment/2010/10/top_gun_2.html (assessed Oct 25, 2010)

Bumiller, Elizabeth. "U.S. Tweaks Message on Troops in Afghanistan." *NYTimes.com,* November 10, 2010, http://www.nytimes.com/2010/11/11/world/asia/11military.html?scp=1&sq=tweaks%20afghanistan&st=cse (accessed November 15, 2010).

Chief of Naval Operations. *Universal Naval Task List.* OPNAVINST 3500.38B. Version 3.0. January 30, 2007.

Ciotti, Paul. "Clinton's War on the Navy." *WorldNetDaily.* http://www.wnd.com/index.php?fa=PAGE.printable&pageId=4039. (assessed Nov 30, 2010)

Commander of Naval Air Forces. *3500.1C T&R Matrices.* Encl 1 VFA Training Matrix. August 5, 2010.

Commander of Naval Air Forces. *F/A-18 A-F Combined Wing Training Manual.* CSFWPINST 3500.7C. November 5, 2008.
Commander of Naval Air Forces. *Strike Fighter Weapons & Tactics (SFWT) Briefing Guide.* July 2010.

Commander of Naval Air Forces. *Strike Fighter Weapons and Tactics (SFWT) Program.* CSFWPINST/CSFWLINST 1525.1C-E. December 1999 through March 31, 2010.

Commander of Naval Air Forces. *Squadron Training and Readiness.* CNAFINST 3500.1B. September 21, 2004.

Commander of Naval Air Forces. *Squadron Training and Readiness.* CNAFINST 3500.1B Change 1. August 12, 2005.

Cote, Owen R.. *The future of naval aviation* . Cambridge, Mass.: Massachusetts Institute of Technology, Security Studies Program, 2006.

Defense Science Board Task Force on Future of the Aircraft Carrier . Washington, D.C.: Office of the Under Secretary of Defense For Acquisition, Technology, and Logistics, 2002.

Department of Defense. "DOD News Briefing with Gen. Conway from the Pentagon". Transcript. http://www.defense.gov/Transcripts/Transcript.aspx?TranscriptID=4676. (Accessed November 15, 2010)

Fulghum, David A. "Russia Sells SA-20 to Iran." *Aviationweek.com.* December 12, 2008.http://www.aviationweek.com/aw/generic/story_generic.jsp?channel=awst&id=news/aw121508p2.xml&headline=null&prev=10. (Assessed December 3, 2010).

Gates, Robert M. "A Balanced Strategy: Reprogramming the Pentagon for a New Age." *Foreign Affairs.com.* http://www.foreignaffairs.com/articles/63717/robert-m-gates/a-balanced-strategy (accessed September 20, 2010).

Gates, Robert M. "United States Air Force Academy Speech." *Defense.gov.* March 4, 2011. http://www.defense.gov/transcripts/transcript.aspx?transcriptid=4779 (assessed March 4, 2011)

Gates, Robert M. "United States Military Academy Speech." *Defense.gov.* February 25, 2011 http://www.defense.gov/speeches/speech.aspx?speechid=1539 (assessed March 4, 2011)

Grant, Rebecca. "The clash about CAS. " *Air Force Magazine*, January 2000. http://www.proquest.com/.

Gulf War Air Power Survey. Volume 5. A Statistical Compendium and Chronology. Ft.

Belvoir: Defense Technical Information Center, 1993.

Haghshenass, Fariborz. "Iran's Doctrine of Asymmetric Naval Warfare." PolicyWatch #1179. WashingtonInstitue.org. December 21, 2006.

Hall, George. *Top Gun: the Navy's Fighter Weapons School.* Novato, CA: Presidio Press, 1987.

Harris D.J. "Jack of all trades, master of none. " *United States Naval Institute. Proceedings*, March 2002. http://www.proquest.com/.
House Committee on Armed Services, Seapower and Expeditionary Forces Subcommittee. *Budget Request For Department Of The Navy Aviation Programs: Hearing before Seapower and Expeditionary Forces Subcommittee.*, 111th Cong., 1st sess., May 19, 2009.

Isherwood, Michael W.. *Airpower for hybrid warfare.* Washington, DC: Mitchell Institute Press, 2009.

L Edgar Prina. "Air war Kosovo: Lessons learned and relearned. " *Sea Power,* November 1999. http://www.proquest.com/.

Lambeth, Benjamin S. *American Carrier Airpower At the Dawn of a New Century.* Santa Monica, CA: RAND, National Defense Research Institute, 2005.

Lambeth, Benjamin S. *Combat pair the evolution of Air Force-Navy integration in strike warfare.* Santa Monica, CA: Rand Corp., 2007.

Llinares, Rick. "Naval Aviation's premier training ground: Naval Strike and Air Warfare Center." *Naval Aviation News.* March 1, 2002. http://www.thefreelibrary.com/Naval+Aviation's+premier+training+ground%3A+Naval+Strike+and+Air...-a0108548247 (assessed Nov 15, 2010).

Johnson, Michael H. "Cleared to Engage: Improving the Effectiveness of Joint Close Air Support". *Air & Space Power Journal.* Maxwell AFB: Summer 2008. Vol. 22, Iss. 2.

Kindley, David D. "Why Won't You Drop Damn You". Joint Military Operation's Thesis. Naval War College, 2004.

Klam, Matthew. "Status is ... for Navy Fighter Pilots; An Air-to-Air Kill". *NYTIMES.COM,* November 15, 1998. http://www.nytimes.com/1998/11/15/magazine/status-is-for-navy-fighter-pilots-an-air-to-air-kill.html (accessed Oct 20, 2010)

Kraft, Terry B. *"It Takes a Carrier: Naval Aviation and the Hybrid Fight."* ***Proceedings.***

Vol. 135, Iss. 9. (Sep 2009): 20-25. http://www.proquest.com/

Naval operations concept 2010 implementing the maritime strategy. Washington, D.C.: Dept. of the Navy, 2010.

Naval Aviation Vision. Washington, D.C.: U.S. Navy, Naval Aviation Enterprise, 2010.

Norris, Guy. "X-47B Sorties Ramping Up." Aviationweek.com, Feb 16, 2011. http://www.aviationweek.com/aw/generic/story_generic.jsp?channel=awst&id=news/awst/2011/02/14/AW_02_14_2011_p28-288506.xml&headline=X-47B%20Sorties%20Ramping%20Up (assessed March 5, 2011)

Owen, Robert C.. *Deliberate force a case study in effective air campaigning : final report of the Air University Balkans air campaign study*. Maxwell AFB, Ala.: Air University Press, 2000.

"Pentagon Cuts $6.9 Billion From JSF Procurement Over Five Years." *Inside the Pentagon - 01/27/2011*. (www.insidedefense.com)

Quadrennial Defense Review Report . S.l.: Quadrennial Defense Review, 2010.

Raytheon Press Release. "Raytheon Delivers 250th APG-79 AESA Radar." *PRNEWSWIRE.COM*. http://www.prnewswire.com/news-releases/raytheon-delivers-250th-apg-79-aesa-radar-117231438.html (asessed March 4, 2011).

Report to Congress Kosovo/Operation Allied Force after-action report. Washington, D.C.: Dept. of Defense, 2000.

Rogers, David and Jen Dimascio. "Senate votes to cut F-22 fighter jet funding." *Politico.com*, July 21, 2009. http://www.politico.com/news/stories/0709/25210.html.(Assessed October 15, 2010).

Schank, John F. *Finding the right balance: simulator and live training for Navy units*. Santa Monica, CA: RAND, 2002.

Singer, P. W.. *Wired for war: the robotics revolution and conflict in the twenty-first century*. New York: Penguin Press, 2009.

Strategic Visions Group, USMC. "Patterns, Trends and Future Force Implications". Brief. http://www.quantico.usmc.mil/download.aspx?Path=./Uploads/Files/SVG_Future%20Warfare%20Brief%20APL-JHU%202%20April%2009-no%20notes%20or%20backups.ppt (assessed Oct 25, 2010)

Tilghman, Andrew. "CBO report examines possible JSF cuts." *NavyTimes.com,* May 28, 2010. http://www.navytimes.com/news/2010/05/navy_CBO_report_052910w/ (Assessed October 15, 2010)

United States Government Accounting Office. Report to the Ranking Minority Members, Subcommittees on Total Force and Readiness, Committee on Armed Services, House of Representatives. *MILITARY READINESS Lingering Training and Equipment Issues Hamper Air Support of Ground Forces.* Washington, DC: GAO, 2003.

UPI. "S. Korea issues paper on N. Korea's military." UPI.com. December 30, 2010. http://www.upi.com/Top_News/World-News/2010/12/30/S-Korea-issues-paper-on-N-Korea-military/UPI-85401293714514/ (assessed Jan 3, 2010).

Wilcox, Robert K. *Scream of eagles: the creation of Top Gun and the U.S. air victory in Vietnam.* New York: J. Wiley, 1996.